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ABSTRACT

Several studies have shown that the elderly do not perform well on the Piagetian problems of logical thinking; the present set of studies aimed at demonstrating that the elderly maintain the competence to solve such problems. The first study performed by the authors assessed performance of 60 noninstitutionalized middle-class elderly females on area and volume conservation tasks. On overall performance only 33.3 percent of the subjects were classified as conservers. The second study employed a training paradigm to determine whether simple verbal feedback activated the strategies required for adequate performance on conservation tasks. Twenty-two subjects who failed to conserve in the assessment study were administered a 20-trial training procedure. Half of these subjects received no feedback. An immediate posttest indicated that the feedback group performed significantly better than the control group on the near transfer posttest task and on the five out of six far transfer tasks. The authors argue that the ease with which training effects were established and the improved performance after training support the view that the elderly maintain competence to adequately solve problems of logical thinking. (Author/SE)

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Area and Volume Conservation Among the Elderly: Assessment and Training

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Running Head: Area and Volume Conservation Among the Elderly

Footnotes

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Abstract

Two studies were conducted to examine whether the elderly maintain the competence to adequately solve problems of logical thinking. The first study assessed performance of 60 noninstitutionalized middle-class elderly females on area and volume conservation tasks. On overall performance only 33.3% of the subjects were classified as conservers. The second study employed a training paradigm to determine whether simple verbal feedback activated the strategies required for adequate performance on conservation tasks. Twenty-two subjects who failed to conserve in the assessment study were administered a 20-trial training procedure. Half of these subjects received simple verbal feedback following each response while half received no feedback. An immediate posttest indicated that the feedback group performed significantly better than the control group on the near transfer posttest task and on the majority of far transfer tasks. The results are discussed in terms of the competence-performance distinction.

Area and Volume Conservation Among the Elderly: Assessment and Training

While traditional quantitative assessments of intellectual performance among the elderly are equivocal in their findings (Birren, 1964), recent qualitative assessments have consistently indicated that the elderly perform poorly on Piagetian tasks of logical thought. Although populations and task procedures differ in the various studies, poor performance has been found in areas as diverse as animistic thinking (Dennis & Mallinger, 1949), classification (Annett, 1959; Denney & Denney, 1973; Denney & Lennon, 1972), egocentrism (Looft & Charles, 1971; Rubin, Attewell, Tierney & Tumolo, 1973), multiple classification (Storck, Looft & Hooper, 1972), conservation (Coleman, 1972; Kominski, 1968; Papalia, Kennedy & Sheehan, 1973; Papalia, Salverson & True, 1973; Rubin, 1973, Rubin et al.,1973; Sanders, 1965; Sanders, Laurendeau & Bergeron, 1966), and several formal operational tasks (Clayton & Overton, 1973; Coleman, 1972; Papalia, 1972; Papalia, Salverson & True, 1973; Stork et al., 1972).

Many of these studies have assumed that with the inevitable neurological deterioration accompanying senescence there is also a loss of cognitive structures necessary for logical thought (Dennis & Mallinger, 1949; Kominski, 1968; Papalia, 1972; Sanders, 1965; Sanders et al., 1966; Rubin et al,, 1973). This idea of structural regression presents difficulties for Piaget's theory since the theory suggests that the operations of previous stages are integrated with and therefore modified by the acquisitions of a new stage and that formal operational thought continues throughout one's entire adult life (Piaget & Inhelder, 1969).

Arguing against the notion of structural regression, Bearison (1974) suggested that the decline in the cognitive functioning of older subjects is due to nonstructural regression or to "an increasingly wider gap between competence and performance" (p. 27). In this interpretation, competence refers to the formal logical representation of the structures of some domain while performance refers to the psychological processes by which information embodied in competence is assessed and utilized in real situations (Flavell & Wohlwill, 1969). It has been suggested (Clayton & Overton, 1973) that rather than assuming that the elderly have lost the underlying structural competence required for logical task solutions, they may simply be exhibiting performance or utilization deficits that reflect any of a number of task or situational factors. Such factors include unfamiliarity with the testing situation, a constricting life space, disuse of relevant skills or strategies or preferential modes of thinking.

In order to examine this notion of performance deficits in the context of stable competence, it is necessary to go beyond traditional assessment studies of the elderly. As Beilin and Kagan (1969) suggested, assessment studies reflect the experiences of the subject but only training can get at competence. That is, to the extent that short-term training leads to relatively rapid effects, it is more parsimonious to assume that training has influenced superficial characteristics (e.g., attention, motivation, etc.) defined as performance factors, than to assume that training has influenced underlying structural competence (Beilin, 1971). Ease of training would suggest the activation of already present cognitive structures (cf. Overton, 1975; Overton, Wagner & Dolinsky, 1971), whereas difficulties in training would suggest a structural deficiency.

While there have been numerous training studies related to the development of logical structures in the child, there is little information available concerning the effects of conservation training with elderly subjects. The primary aim of the present research is to explore the hypothesis that the elderly maintain the competence to adequately solve Piagetian conservation problems and will conserve when such strategies are activated. Two studies are presented. The first assesses area and volume conservation abilities in elderly subjects. In the second study, subjects who fail to conserve during the assessment study are trained and performance is assessed on a posttest.

Study 1: Assessment

Method

Subjects

Subjects were 60 Caucasian noninstitutionalized middle-class females. Ages of the subjects ranged from 65.1 years to 75.9 years ($\bar{X}$ = 70.3, SD = 3.5). Only subjects educated in the United States and who had at least a 6th grade education were included. Educational attainment ranged from 6 years to 18 years ($\bar{X}$ = 10.2, SD = 2.5).

Subjects were current participants in the activities of any one of nine senior citizen centers in Philadelphia. All subjects were volunteers and were tested individually in their own homes by the senior author. Each testing session took approximately one hour. Subjects were free of marked auditory and visual impairment.

Procedure

Subjects were first administered Form 1 of the Quick Test (Ammons & Ammons, 1962), a brief screening test of general intelligence. Any sub-

ject with a Quick Test score of less than 85 was excluded from further testing. Quick Test scores for the 60 subjects ranged from 86 to 145 ($\bar{X}$ = 117.3, SD = 13).

Following the Quick Test, six Piagetian conservation tasks were administered to each subject individually in order to assess the subject's understanding of area and volume concepts. The presentation order of tasks was randomized by a Latin square design and the various orders were distributed equally among the 60 subjects. Subjects were given as much time as necessary to complete each task.

Each of the three area conservation tasks (area method one, area method two, and surfaces) and each of the three volume conservation tasks (interior volume, occupied volume, and displacement volume) were composed of three conservation trials and a check trial.

Regardless of the property being conserved, each conservation trial consisted of an initial presentation of two quantitatively and perceptually equivalent stimuli. Following the subject's verification of equivalence, the shape of one stimulus was transformed. The subject was asked again if the two stimuli were the same or different in terms of the quantitative property being considered. The two types of comparisons within a conservation question were alternated within and across tasks such that the "same" comparison constituted the first part of the question for half the trials and the "different" comparison for the other half. If the subject asserted that the stimuli were different, she was asked to indicate which stimulus was more or less in terms of the relevant quantitative property. The use of the terms "more" and "less" was randomized within and across tasks.

Except for the conservation of surfaces task, after each transformation the transformed stimulus was returned to its original state and its equivalence to the standard was ascertained prior to the execution of further transformations. While the same procedure was followed on all conservation trials, for most tasks the second transformation was the most perceptually deceiving of the three conservation trials. In addition, when a subject passed (or failed) the first two conservation trials, it was assumed that the third trial would be passed (or failed) and therefore the third trial was not administered. Finally, on the check trial, one of the two stimuli was intentionally made quantitatively unequal to the standard. This trial served as a check for the occurrence of false positives based on a subject's tendency to assert equivalence regardless of the type of transformation.

Following each trial, the subject was asked to explain the basis of her judgment and explanations were recorded verbatim. An explanation was considered adequate if it could be classified as one of the following: compensation argument, identity argument, statement of operation performed, addition/subtraction, or reversibility.

Tasks

The following is a description of the conservation tasks:

Area method one. (Modified from Goldschmid, 1967; and Piaget, Inhelder & Szeminska, 1960)

Subjects compared two rectangles composed of 10 one-inch white cardboard squares placed on a black background. The rectangles were constructed in two horizontal rows with five squares in each row. The subject was asked a question of the following type: "Do these two pat-

terns cover the same amount of space or do they cover different amounts of space?" The three transformations consisted of the spatial relocation of one of the smaller constituent squares, the lower left square to a position around the periphery of its respective figure. The one-inch square was relocated to (a) the lower right portion of the variable figure, (b) the top right portion of the variable figure, and (c) the top left portion of the figure. On the fourth trial, after the two large squares had been placed in their original identical arrangement, the lower left square of the variable figure was removed as a check.

Surfaces. (Modified from Goldschmid & Bentler, 1968; and Shantz & Sigel, 1967)

Subjects compared two green cardboard rectangles (9 x 12 in.), representing grass fields, with a little brown plastic cow in the center of each field and two red barns (3/4 in. x 1/2 in. x 1/2 in.) placed close together along the top edge of each field. The second trial began with ten barns placed in two connected rows of five along the top edge of each field, and the third trial began with six barns placed close together along the top edge of each field. Subjects were asked a question of the following type: "Do the two cows have the same amount of grass to eat or does one cow have more grass to eat than the other cow?" The three transformations consisted of the scattering of the barns on the variable field while the barns on the standard field remained in a row along the top edge of the field. On the fourth trial equivalence was reestablished on each field and two barns were then removed from the variable field as a check.

Interior volume. (Modified from Piaget et al., 1960; and Storck et

al., 1972)

Subjects compared two houses built on a plot of green grass, represented by a severed portion of green Lego board. One house was composed of 12 red interlocking Lego blocks (5/8 in. x 5/8 in. x 3/8 in.) and the other was composed of 12 white interlocking blocks (5/8 in. x 5/8 in. x 3/8 in.). The dimensions of the houses, when quantitatively and perceptually equivalent, were 2 blocks x 3 blocks x 2 blocks. Subjects were asked a question of the following type: "Is there the same amount of space inside each house or does one house have more space inside it than the other?" The three conservation trials consisted of transforming the white house to (a) a 2 block x 2 block x 3 block configuration, (b) a 1 block x 2 block x 6 block configuration, and (c) a 3 block x 2 block x 2 block configuration. On the check trial, after the houses were both in a 2 block x 3 block x 2 block arrangement, four blocks were removed from the side of the white house leaving a 2 block x 2 block x 2 block arrangement.

Occupied volume. (Modified from Piaget et al., 1960; and Storck et al., 1972)

The same procedure was followed as for interior volume except that the standard red house was placed in one of two large clear containers half-filled with water and the standard question was of the following type: "If I would place the white house in this container of water (experimenter points to the empty container), would it take up the same amount of space in the water as this red house or a different amount of space?"

Displacement volume. (Modified from Piaget et al., 1960; and Storck

et al., 1972)

The same procedure was followed as for occupied volume; however, the standard question was of the following type: "If I would place this white house in the water would the water level, or where the water comes to in this container, be the same as the level in the container with the red house or would it be different?"

Scoring

A quantitative score ranging from 0 to 5 was assigned for each task on the basis of whether the subject responded correctly to the conservation and check trials and gave adequate explanations. Since there were six tasks, a subject's total possible score was 30.

Subjects were also classified according to the following qualitative stages:

Nonconserver. For any one task a subject was classified a nonconserver if she failed to respond correctly to 2 of the 3 conservation trials, or if she responded correctly but gave inadequate explanations and failed the check. Across tasks a nonconserver was a subject who failed all six tasks or who was a nonconserver on five tasks and a partial conserver on one task.

Partial conserver. For any one task, a subject was classified a partial conserver if she correctly responded to 2 of the 3 conservation trials but either gave an inadequate explanation or failed the check. A subject was classified a partial conserver across tasks if she fell between the nonconserver and conserver criteria, i.e., she displayed some combination of nonconserving, partially conserving and conserving across the six tasks.

Conserver. For any one task a subject was classified a conserver if she gave correct responses and adequate explanations on at least 2 of the 3 conservation trials and passed the check. Across tasks a conserver was a subject who conserved on all six tasks or who conserved on five tasks and was a partial conserver on one task.

Results

Table 1 presents the number of conservers on the area and volume tasks based on the qualitative stage classifications. The percentage of subjects conserving on individual tasks ranged from 43.3% to 75%. Over all tasks only 33.3% of the subjects were classified as conservers.

Insert Table 1 about here

The first 4 tasks listed in Table 1 are generally understood to be concrete operational tasks, while occupied and displacement volume are typically considered formal operational tasks (Piaget et al., 1960). It is clear from Table 1 that conservation performance did not decline in the reverse order of the typical acquisition sequence. That is, the formal operational tasks were not the most difficult tasks for these elderly subjects.

Pearson product moment correlation coefficients were computed among the following variables: age, educational level, Quick Test score, occupational level, performance on each of the six tasks (score: 0-5) and overall performance (score: 0-30). As indicated in Table 2, educational level was positively related to Quick Test score, confirming Shock's (1951) point regarding the importance of education in determining vocabulary size in later maturity.

Insert Table 2 about here

A significant positive relationship was also present between educational level and performance on four of the six tasks: area method one, area method two, surfaces, and occupied volume, as well as between educational level and overall performance.

Discussion

The results of this assessment study support earlier findings that older adults demonstrate poor performance on Piagetian logical tasks. Only 33.3% of the subjects were classified as conservers on the basis of their performance on all six tasks. However, when population characteristics are roughly comparable, the subjects in the present study show smaller performance deficits on the surfaces and volume tasks than the subjects in earlier studies (e.g., Papalia, 1972; Papalia, Kennedy & Sheehan, 1973; Papalia, Salverson & True, 1973; Sanders, 1965; Sanders et al., 1966). Of the remaining two tasks, i.e., area method one and area method two, only the former has been employed in studies with older subjects (Rubin, 1973; Rubin et al., 1973). Since performance on the area method one task was not analyzed separately from performance on other tasks in these studies, comparisons between these results and our own results cannot be made.

While it is difficult to explain the superior performance of subjects in this study, as compared to the performance of elderly subjects in earlier studies, it is important to note that the present scoring criteria were less conservative than the criteria employed in other studies. That is, a subject was considered a conserver on a task even if one of the three conservation trials was not passed. Also, there was a category for

partial conservers on each task as well as over all tasks. However, while subjects in this study performed somewhat better than elderly subjects in similar assessment studies, their performance was still significantly poorer than would be predicted from research employing the same tasks with children.

Several studies have suggested that elderly subjects lose the ability to solve Piagetian tasks in an order which is the reverse of the typical acquisition sequence (Clayton & Overton, 1973; Coleman, 1972; Papalia, 1972; Papalia, Salverson & True, 1973; Storck et al., 1972). Two explanations based on procedural differences among studies may be sufficient to account for the fact that the subjects in this study did not perform more poorly on the formal operational occupied volume and displacement volume tasks than on the concrete operational tasks. First, the subjects' justifications that were accepted as adequate on the formal operational volume tasks in this study did not require the calculation of volume as a function of length, width and height. Second, a subject's justification postulating a simple equality of weight of the two houses involved in the volume tasks was accepted as adequate. Each explanation suggests that the criterion for inclusion as a formal operational conserver in this study may have been less demanding than in other studies.

The positive relationship found between educational level and conservation performance in this study is in accord with several other findings that point to the positive relationship between educational level and the cognitive performance of elderly subjects (Hawley & Kelly, 1973; Kogan, 1974; Papalia, Kennedy & Sheehan, 1973; Papalia, Salverson & True, 1973). According to Granick and Friedman (1973), subjects who already

have a good deal of education are likely to continue adding to their knowledge and to maintain their intellectual effectiveness. On the basis of informal conversations with these elderly subjects, the authors noted that most of the subjects who were participating in adult educational activities were indeed the subjects who had attained higher educational levels.

Finally, as discussed earlier, the primary aim of the present research is to examine the hypothesis that the poor performance on logical tasks manifested by elderly subjects is indicative of performance or utilization declines and not of declines in underlying structural competence. Having established the poor performance of these subjects, the next step in the exploration of this hypothesis is to introduce training procedures with those subjects who initially failed the conservation tasks. Significant performance increments following a short-term training procedure would support the hypothesis, while lack of performance increments would support a structural regression hypothesis.

Study 2: Training

The second study employed a training paradigm to determine whether simple verbal feedback activated strategies required for adequate performance on conservation tasks among elderly subjects. Since more than 50% of the subjects in Study 1 failed the conservation of surfaces task, a task similar to the surfaces task was employed for training. The original surfaces task was then employed for near transfer assessment and the remaining five tasks were employed for far transfer assessment.

Method

Subjects

Twenty-two of the subjects who failed the conservation of surfaces task in Study 1 were included in the training study. Other subjects who failed on the surfaces task either refused to participate in further testing ($n = 3$) or were excluded because they had conserved on the five remaining tasks ($n = 6$) and there could be no improvement on these far transfer tasks after training.

Ages of the subjects ranged from 65.1 years to 75.9 years ($\bar{X} = 71$, $SD = 1.8$). The range of Quick Test scores for these subjects was 95 to 145 ($\bar{X} = 110.5$, $SD = 15.7$). The mean age and mean Quick Test scores for the 22 subjects in the training study did not differ significantly from the mean age and the mean Quick Test scores of the 60 subjects in Study 1, $t(21) = .90$, $p > .05$ and $t(21) = 2.0$, $p > .05$, respectively. However, mean educational level of subjects in the training study was significantly lower than mean educational level in the assessment study, $t(21) = -2.8$, $p < .02$.

Design

Eight of the 22 subjects had been nonconservers overall on the assessment pretest tasks. Four of these subjects were assigned to a feedback group and four to a no-feedback control group. The subjects in each group were matched according to pretest performance, age, educational level, and Quick Test score. The 14 remaining subjects had been partial conservers overall on the assessment tasks. Seven subjects were assigned to the feedback group and seven to the no-feedback control group. The subjects in each group were matched according to pretest performance, age,

educational level and Quick Test score.

Procedure

Training. Feedback and control groups were administered a 20-trial procedure that involved the same operation of complementary area as the surfaces task. The solution to both tasks is based in part upon subtracting smaller congruent areas from larger congruent areas. However, the training task was different from the surfaces task in that different materials, different questions, and different configurations were used. Multi-colored one-inch wooden cubes were placed in various numerical and spatial arrangements on two 9 x 12 in blue cardboard rectangles. In each of the two sets of ten trials there were three identity trials in which the arrangements on both boards were identical. There were also four conservation trials in which the same number of cubes appeared on each board but in different spatial configurations, and there were three check trials in which an unequal number of cubes appeared on each board.

The standard question asked on each trial was of the following type: "Is there the same amount of blue space remaining on each board or does one board have more blue space remaining than the other?" The two types of comparisons were alternated such that the "same" comparison constituted the first part of the question for half the trials and the "more" comparison for the other half. Only after the 10th trial and the 20th trial was an explanation required.

At the beginning of training, subjects in the feedback group were told they would be informed as to the correctness or incorrectness of their responses. When subjects in the feedback group gave a correct response the experimenter replied "Yes, that's right. Let's go on". When

subjects gave an incorrect response, the experimenter replied "No, that's not right. There is(is not) the same amount of space remaining on each board". No feedback was offered concerning the adequacy of the two explanations. The same 20-trial procedure was administered to the control group but they received no feedback after each response.

The training procedure took approximately 15 minutes to administer and the training score computed was the number of correct responses on the 20 trials. The average length of time intervening between pretest assessment and training was 2.6 months.

Immediate posttest. Immediately following the training procedure, the six assessment tasks were readministered to the subjects in the same order of presentation as they had been administered during Study 1.

Results

A first major finding concerns the ease with which training effects were established. As suggested earlier, ease of training would suggest the activation of already present cognitive structures, whereas difficulties in training would suggest a structural deficiency. Ease of training is indicated in this study by the fact that on the conservation training trials the feedback group made a total of only eight errors after their first incorrect response while the control group made a total of 60 errors after their first incorrect response.

Insert Table 3 about here

In addition to ease of training, significant training effects were present on both near and far transfer posttest tasks. On the near transfer posttest surfaces task, the feedback group performed significantly

better than the control group ($U = 13$, $p < .001$). This same effect is evidenced in Table 4 where it is shown that of the 11 feedback subjects who were nonconservers on the pretest surfaces task, ten conserved on the posttest surfaces task and one was classified a partial conserver.

Insert Table 4 about here

The feedback group also performed significantly better than the control group on four of the five far transfer tasks: area method one, $U = 22.5$, $p < .01$; area method two, $U = 34$, $p < .05$; interior volume, $U = 26.5$, $p < .05$; and occupied volume, $U = 32$, $p < .05$, as well as on total posttest performance, $U = 22$, $p < .01$.

Further evidence of transfer effects may be seen in Table 4 which presents the number of nonconservers, partial conservers and conservers in the feedback and control groups on pretest and posttest tasks. The number of progressions from a lower stage during pretest to a higher stage during posttest on any task, and the number of regressions from a higher stage to a lower stage were computed for feedback and control groups. While there were no significant differences in the number of regressions made in the two groups (t.e., three regressions in the feedback group, ten in the control group), a significantly greater number of progressions from pretest to posttest were made in the feedback group ($U = 6$, $p < .001$).

It can be seen from Table 4 that some of the control subjects did improve from pretest to posttest. Such improvement is probably a function of increased familiarity with the stimulus materials (see Lester & Klein, 1973) or increased familiarity with the testing situation (see Brainerd & Allen, 1971; Hoyer, Labouvie & Baltes, 1973) as a result of

exposure to the 20-trial training procedure.

Training studies with children often compare the explanations of natural conservers and trained conservers (e.g., Brainerd, 1972). In this study, the pattern of explanations given by subjects who conserved on the posttest tasks corresponded exactly to the pattern of explanations given by pretest conservers. The only exception was that whereas pretest conservers on the surfaces task gave almost as many addition/subtraction arguments as identity arguments, the majority of trained conservers on the surfaces task gave identity explanations. This may be due to the similarity of the training task to the surfaces task and the fact that the predominant explanation on the 10th and 20th trial of the training task was the identity explanation.

Discussion

While there have been successful training studies with elderly subjects in the areas of rigidity (Coleman, 1963), sorting behavior (Crovitz, 1966), response speed (Hoyer et al., 1973) and classification (Denney, 1974), the present study is, to the best knowledge of the authors, the first training attempt with elderly subjects in the area of conservation performance. In this attempt to activate conservation abilities in elderly subjects, simple verbal feedback led to significant improvement in performance on the near transfer task as well as on far transfer tasks. Displacement volume was the only task on which the performance of the feedback and control subjects did not differ significantly after training. As discussed earlier in this paper, occupied and displacement volume are typically considered formal operational tasks, but in light of recent findings that conservation of occupied volume is attainable throughout

the concrete operational period (Andrejczak, 1972), displacement volume might be considered the only formal operational task in the test battery. The fact that feedback on a concrete operational training task led to improvement only on tasks attainable throughout the concrete operational period is consistent with the Piagetian notion of structure d'ensemble. It is suggested that feedback activated structures relevant to the training task and that these operational structures were then applied to other concrete operational tasks but were not useful for solving the formal operational displacement volume task.

The results of this study are consistent with several training studies with children in which feedback procedures enhanced performance on Piagetian logical tasks (Beilin, 1966; Brainerd, 1972, 1974; Kingsley & Hall, 1967; Overbeck & Schwartz, 1970; Siegler & Liebert, 1972). Just as the results of training studies with children have been interpreted in terms of the competence-performance distinction (Beilin, 1971; Overton, 1975; Overton, Wagner & Dolinsky, 1971), so too the results of this study support the hypotheses that older adults maintain the competence to adequately solve Piagetian conservation tasks and will perform correctly when such strategies are activated.

It is most likely that feedback activated existing operational structures and was not merely reinforcing specific responses since the training procedure was brief, feedback led to rapid improvement on the conservation training trials; and the effects of feedback training generalized to both near and far transfer tasks. Both the rapidity and generalization of training effects supports the view that training influenced superficial performance factors and not underlying structural competence.

This point is similar to the suggestions made by Amidon and Carey (1972) and Holland and Palermo (in press) that the speed and ease with which a brief training procedure leads five year olds to distinguish the concepts "before" and "after", and "less" and "more", respectively, indicates that the inability to distinguish between the concepts is probably more a reflection of a superficial problem than a reflection of an operational deficit or lack of competence. On the basis of the present findings, it seems reasonable to conclude that the elderly, in general, maintain the relevant strategies in competence and simple verbal feedback activates those strategies into performance. Thus, it seems premature to postulate, as did Hooper, Fitzgerald and Papalia (1971), that Piagetian logical functioning is subject to qualitative disorganization and regression with advancing years as a function of the neurological decay inherent in the aging process.

Related to the question of whether certain procedures activate already existing cognitive structures is the further question of whether such procedures produce a stability of successful performance over time. To assess whether training effects were maintained over time in the present study, six subjects who conserved on the surfaces posttest task were revisited six weeks after training. Three of the subjects had been partial conservers overall on the pretest and were given feedback training and three had been partial conservers overall on the pretest but were in the control group. The six conservation tasks were again administered to these subjects as a delayed posttest. While it is not possible to draw strong conclusions based on so few subjects, there was some evidence that subjects in the control group regressed more over the six-week period than

subjects in the feedback group. There were five regressions among the control subjects and two regressions among the feedback subjects. These findings lend some tentative support to the suggestion that activation procedures do lead to stable performance over time. This, however, is an area that obviously requires more systematic investigations.

In conclusion, while Horn (1971) viewed as defensive any attempt to discover procedures demonstrating the worthiness of the aged, we view such an approach as both necessary and positive. It is necessary in the sense that it extends assessment research and permits more valid judgments as to whether older subjects are manifesting their full potential in testing situations. It is positive in that it provides a basis for questioning widely held stereotypes regarding deteriorating mental abilities in the aged.

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Table 1

Number of Conservers on Area and Volume Conservation Tasks [a]

	Nonconservers	Partial Conservers	Conservers
Area method one	17 (28.3)[b]	1 (1.7)	42 (70)
Area method two	22 (36.7)	1 (1.7)	37 (61.7)
Surfaces	31 (51.7)	3 (5)	26 (43.3)
Interior volume	14 (23.3)	1 (1.7)	45 (75)
Occupied volume	16 (26.7)	6 (10)	38 (63.3)
Displacement volume	14 (23.3)	12 (20)	34 (56.7)
Over all tasks	8 (13.3)	32 (53.3)	20 (33.3)

[a] $n = 60$

[b] Percentages are in parentheses.

Table 2

Intercorrelations Among Demographic Characteristics, Scores on Each Conservation Task (Area method one, Area method two, Surfaces, Interior volume, Occupied volume, and Displacement volume) and Total Conservation Performance Score [a]

	Age	Education	Quick Test	Occupation	Area (1)	Area (2)	Surf.	IV	OV	DV	Total
Age											
Education	.02										
Quick Test	-.20	.46***									
Occupation	.00	.12	.25*								
Area (1)	-.12	.29*	.31**	-.18							
Area (2)	-.10	.27*	.20	-.14	.72***						
Surf.	-.16	.35**	.15	-.18	.59***	.61***					
IV	-.15	-.05	.03	..07	.46***	.43***	.40***				
OV	-.01	.29*	.07	.18	.54***	.49***	.45***	.51***			
DV	.05	.15	.08	.17	.32**	.34**	.30**	.42***	.71***		
Total	-.09	.29*	.18	-.02	.79***	.80***	.75***	.71***	.81***	.68***	

[a] $n = 60$

* $p < .05$

** $p < .01$

*** $p < .001$

Table 3

Mean Pretest and Posttest Scores of Feedback and Control Groups

	Feedback				Control			
	Pre		Post		Pre		Post	
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD
Area method one	2.3	2.0	4.5	.69	2.0	1.9	1.9	2.0
Area method two	1.2	2.1	4.1	2.0	.45	1.2	1.9	2.5
Surfaces	.27	.47	4.8	.60	.45	.52	1.5	2.1
Interior volume	2.6	2.5	3.9	1.9	3.1	2.3	1.9	2.2
Occupied volume	1.7	2.1	4.1	1.7	1.7	1.9	1.9	2.5
Displacement volume	1.9	2.2	2.3	2.6	2.1	1.6	2.1	2.5
Over all tasks	10	8.1	23.7	7.2	9.8	7.0	11.2	10.3

Note: Maximum score on each task = 5.

Table 4

Number of Nonconservers, Partial Conservers, and Conservers in Feedback and Control Groups Before and After 20-Trial Training Procedure

	Tasks																				
	Area M 1			Area M 2			Surfaces			Interior Volume			Occupied Volume			Displacement Volume			Overall		
Group	NC	PC	C	NC	PC	C	NC	PC	C	NC	PC	C	NC	PC	C	NC	PC	C	NC	PC	C
Feedback																					
Pretest	7	0	4	8	1	2	11	0	0	5	0	6	6	2	3	6	2	3	4	7	0
Posttest	0	1	10	2	0	9	0	1	10	2	1	8	1	2	8	6	0	5	0	6	5
Control																					
Pretest	7	1	3	10	0	1	11	0	0	4	0	7	5	3	3	3	7	1	4	7	0
Posttest	8	0	3	7	0	4	8	0	3	6	1	4	7	0	4	6	1	4	3	6	2